

## Appendix B

## Tobamovirus Helicase

1  
 TMV-KR QQMSSIVYTGPIKVQQMKNFIDSLVASLSAAVSNLVKILKDTAAIDLETR  
 TMV-RAK QQMSSIVYTGPIKVQQMKNFIDSLVASLSAAVSNLVKILKDTAAIDLETR  
 TMV-vu1 QQMSSIVYTGPIKVQQMKNFIDSLVASLSAAVSNLVKILKDTAAIDLETR  
 TOMV QQMCSIVYTGPLKVQQMKNFIDSLVASLSAAVSNLVKILKDTAAIDLETR  
 PMMV QQMHAMVYTGPLKVQQCKNYLDSLVAASLSAAVSNLKKI IKDTAAIDLETK  
 TMGMV QQMASVVYTGSLKVQQMKNYVDSLAAASLSATVSNLCKSLKDEVGYDSDSR  
 TMV-OB NKMASIVYSGPLQVQQMQNYVDSLAAASLSATVSNLCKLVKDSSVGFQDSL  
 ORSV KSMSSAVYTGPLKVQQMKNYMDYLSASISATVSNLCKVLKDVYGVDPESA  
 TVCV GTMMSAVYTGSIKVQQMKNYIDYLSASLAATVSNLCKVLRDVHGVDPESQ  
 CR-TMV GTMMSAVYTGSIIEVRQMKNYIDYLSASLSATVSNLCKVLRDVHGVDPESQ  
 RMV-SH GAMMSAVYTGKIKVQQMKNYVDYLSASLSATVSNLCKVLRDVHGVDPESQ  
 CRMV GAMMSAVYTGKIKVQQMKNYVDYLSASLSATVSNLCKVLRDVHGVDPESQ  
 TMV-CG GAMMSAVYTGKIKVQQMKNYVDYLSASLSATVSNLCKVLRDVHGVDSQS  
 CGMMV KTITPVVYTGITIRERQMKNYIDYLSASLGSTLGNLERIVRSDWNGTEESM  
 CGMMV-W KTITPVVYTGITIRERQMKNYIDYLSASLGSTLGNLERIVRSDWNGTEESM  
 CFMMV KTITPVIYTGPIRVQRMANLYDYL SANLAATIGILERIVRSNWSGN-EVV  
 YCGMMV KSITPVIYTGPIRVQRMANLYDYL SASLTATIGNLERIVSSWTGENELV  
 SHMV QKPVNIVYTGGEVQICQMKNYLDYLSASLVACISNLKKYLQDQWLNPGEKF

51  
 TMV KR QKFGVLDVASRKWLIKPTAKSHAWGVVETHARKYHVALLEYDE-QGVVTC  
 TMV-RAK QKFGVLDVASRKWLIKPTAKSHAWGVVETHARKYHVALLEYDE-QGIVTC  
 P03586 TMV QKFGVLDVASRKWLIKPTAKSHAWGVVETHARKYHVALLEYDE-QGVVTC  
 TOMV QKFGVLDVASRKWLKPSAKNHAWGVVETHARKYHVALLEHDE-FGIITC  
 PPMV EKFGVYDVCLKKWLKPLSKGHAWGVVMDSDYKCFVALLTYDG-ENIVCG  
 TMGMV EKVGVWDVTLKKWLLKPAAGHSGVVDYKGMFTALLSYEG-DRMVTE  
 TMV OB SKVGVFVDRKKMWLIKPTLKNHSGVVDYKGMFTALLSYHN-ELPICD  
 ORSV EKSGVYDVVGKWI IKPKDKCHAWGVADLNNGEKVIVLLEWAD-GFPIC-  
 TVCV EKSGVWDVRRGRWLLKPNKCHAWGVAEDANHKLVIIVLLNWDD-GKPVCD  
 CR-TMV EKSGVWDVRRGRWLLKPNKCHAWGVAEDANHKLVIIVLLNWDD-GKPVCD  
 RMV-SH EKSGVWDVRRGRWLLKPNKCHAWGVAEDANHKLVIIVLLNWDE-GNPVCD  
 CRMV EKSGVWDVRRGRWLLKPNKCHAWGVAEDANHKLVIIVLLNWDE-GKPVCD  
 TMV-CG EKSGVWDVRRGRWLLKPNKCHAWGVAEDANHKLVIIVLLNWDE-GKPVCD  
 CGMMV QTFGLYDCEKCKWLLLPAAKKHAWAVVLASDDTTRIIFLSYDESGSPIID  
 CGMMV-W QTFGLYDCEKCKWLLLPAAKKHAWAVVLASDDTTRIIFLSYDESGSPIID  
 CFMMV QTYGLFDCQANKWILLPSEKTHSWGVCCLTMDDKLRVLLQYDSAGWPID  
 YCGMMV QTYGLFDCQADKWILQPTERTHSWGVCCLTMDDKLRIVLLQYDEFDWPID  
 SHMV QKIGVWDNLNNKWIIVPQKKKYAWGLAADVDGNQKTIVILNYDEHGMPILE

101  
 TMV KR -DNWRRVAVSSESVMYSDMAKLRTLRRLLRNAGEPHVSSAKVVLVDGVP GC  
 TMV-RAK -DDWRRVAVSSESVMYSDMAKLRTLRRLLRDGEPHVSNKVVVLVDGVP GC  
 P03586 TMV -DDWRRVAVSSESVMYSDMAKLRTLRRLLRNAGEPHVSSAKVVLVDGVP GC  
 TOMV -DNWRRVAVSSESVMYSDMAKLRTLRRLLKDGEPHVSSAKVVLVDGVP GC  
 PPMV -ETWRRVAVSSESVMYSDMGKIRAIRSVLKDGEPISSAKVTLVDGVP GC  
 TMGMV -SDWRRVAVSSDTMVYSIAKLQNLRTMRDGEPEPTAKMVLVDGVP GC  
 TMV OB -ADWSKVAVSNESMVYSDMAKLRLVLRKSI GEMPI SVSSAKVTLVDGVP GC  
 ORSV -GDWRRVAVSSDSLIYSDMGKLQTLRLCKDGEPLRMPKVTLVDGVLGC  
 TVCV -ETWFRVAVSSDSLIYSDMGKLKTLTSCSPNGEPPEPNAKVILVDGVP GC  
 CR-TMV -ETWFRVAVSSDSLIYSDMGKLKTLTSCSPNGEPPEPNAKVILVDGVP GC  
 RMV-SH -ETWFRVAVSSDSLIYSDMGKLKTLTACCRDGEPEPTAKVVLVDGVP GC  
 CRMV -ETWFRVAVSSDSLIYSDMGKLKTLTSCCRDGEPEPTAKVVLVDGVP GC  
 TMV-CG -ETWFRVAVSSDSLIYSDMGKLKTLTACCRDGEPEPTAKVVLVDGVP GC  
 CGMMV KKNWKRFAVCSETKVYSVIRSEVLNKE----AIVDPGVHITLVDGVP GC  
 CGMMV-W KKNWKRFAVCSETKVYSVIRSEVLNKE----AIVDPGVHITLVDGVP GC  
 CFMMV KSFWKAFVCADTKVFSVIRSEVLNKE----PLVEPDAKYVLIDGVP GC

YCGMMV KSSWKAFCVSADTKVFSIIRSLEVLSSL-----PLSDPTAKFTLIDGVPGC  
 SHMV -KSYVRLVSTDTYLFVTVSMLGYLRHL-----DQKKPTATITLVDGVPGC

151

TMV KR GKTKEILSRVNFDEDLILVPGKQAAEMIRRRANS-SGIIIVATKDNVKTVD  
 TMV-RAK GKTKEILSRVNFDEDLILVPGKQAAEMIRRRANS-SGIIIVATKDNVKTVD  
 P03586 TMVGKTKEILSRVNFDEDLILVPGKQAAEMIRRRANS-SGIIIVATKDNVKTVD  
 TOMV GKTKEILSRVNFDEDLILVPGRQAAEMIRRRANA-SGIIIVATKDNVKTVD  
 PPMV GKTKEILSRVNFDEDLILVPGKQAAEMIRRRANS-SGLIVATKENVKTVD  
 TMGMV GKYKGFERFDLDEDLILVPGKQAAEMIRRRANS-SGLIRATMDNVKTVD  
 TMV OB GKTKEILRRVNFSEDLVLVPGKEAAAMIRKRAHQ-SGNIIVANNNDNVKTVD  
 ORSV GKTKEILETVNFDEDLILVPGKEACKMIIRKRAHQ-SGHVRATKDNVKTVD  
 TVCV GKTKEILEKVNFEEDLILVPGKEASKMIIRRAHQ-AGVIRADKDNVKTVD  
 CR-TMV GKTKEILEKVNFEEDLILVPGKEASKMIIRRAHQ-AGVIRADKDNVSTVD  
 RMV-SH GKTKEILEKVNFEEDLVLVPGKEASKMIIRRAHQ-AGVTRADKDNVKTVD  
 CRMV GKTKEILEKVNFEEDLVLVPGKEASKMIIRRAHQ-AGIIRADKDNVKTVD  
 TMV-CG GKTKEILEKVNFEEDLVLVPGKEASKMIIRRAHQ-AGIIRADKDNVKTVD  
 CGMMV GKTAELIARVNWKTDLVLTGREAAMIRRRACALHKSVPATNDNVRTFD  
 CGMMV-W GKTAELIARVNWKTDLVLTGREAAMIRRRACALHKSVPATNDNVRTFD  
 CFMMV GKTQEIISSADFKTDLILTGPKEAAAMIRRRANMKYRSPVATNDNVRTFD  
 YCGMMV GKTQEIISSADFKTDLILTGPKEAAAMIRRRANAKFRGCVATNDNVRTFD  
 SHMV GKTQEILSRFDANSDLILVQGREACEMIRRRAND-NVPGSATKENVRTFD

201

TMV KR SFMMNFGKSTRCQFKRLFIDEGLMLHTGCVNFLVMSLCEIAYVYGDQQ  
 TMV-RAK SFMMNFGKSTRCQFKRLFIDEGLMLHTGCVNFLVMSLCEIAYVYGDQQ  
 P03586 TMVSFMMNFGKSTRCQFKRLFIDEGLMLHTGCVNFLVMSLCEIAYVYGDQQ  
 TOMV SFLMNYGKGARCFKRLFIDEGLMLHTGCVNFLVMSLCEIAYVYGDQQ  
 PPMV SFLMNYGRGP-CQYKRLFIDEGLMLHGPCVNFLVMSLCEIAYVYGDQQ  
 TMGMV SLLMH---PKPRSHKRLFIDEGLMLHTGCVNFLVMSLCEIAYVYGDQQ  
 TMV OB SFLMNLGKGPVCQFKRLFIDEGLMLHGPCVYFLVKSLSLCEIAYVYGDQQ  
 ORSV SFLMH---LKPPTYNKLFIIDEGLMLHTGCVNFLIALSHCREAMVFGDTEQ  
 TVCV SFLMH---PSRRVFKRLFIDEGLMLHTGCVNFLVMSLCEIAYVYGDQQ  
 CR-TMV SFLMH---PSRRVFKRLFIDEGLMLHTGCVNFLVMSLCEIAYVYGDQQ  
 RMV-SH SFLMH---PPKRVFKRLFIDEGLMLHTGCVNFLVMSLCEIAYVYGDQQ  
 CRMV SFLMH---PPKRVFKRLFIDEGLMLHTGCVNFLVMSLCEIAYVYGDQQ  
 TMV-CG SFLMH---PPKREFKRLFIDEGLMLHTGCVNFLVMSLCEIAYVYGDQQ  
 CGMMV SFVMN---RKIFKFDVAVYVDEGLMVHTGLLNFALKISGCKKAFVFGDAKQ  
 CGMMV-W SFVMN---RKIFKFDVAVYVDEGLMVHTGLLNFALKISGCKKAFVFGDAKQ  
 CFMMV SFVMN---KKPFTFKTLWVDEGLMVHTGLLNFALKISGCKKAFVFGDAKQ  
 YCGMMV SFVMN---KKPFTFKTLWVDEGLMVHTGLLNFALKISGCKKAFVFGDAKQ  
 SHMV SFVMN---RKPGKFKTLWVDEGLMVHTGLLNFALKISGCKKAFVFGDAKQ

251

TMV KR IPYINRVSGFPYPAHFAKLEVDEVETRRTTLRCPADVTHYLNRRYEGFVM  
 TMV-RAK IPYINRVSGFPYPAHFAKLEVDEVETRRTTLRCPADVTHYLNRRYEGFVM  
 P03586 TMVIPYINRVSGFPYPAHFAKLEVDEVETRRTTLRCPADVTHYLNRRYEGFVM  
 TOMV IPYINRVSGFPYPAHFAKLEVDEVETRRTTLRCPADVTHYLNRRYEGFVM  
 PPMV IPYINRVATFPYPKHLSQLEVDVETRRTTLRCPADITFFLNQKYEGQVM  
 TMGMV IPYINRVQNFPPYPKHFEKLQVDEVETRRTTLRCPGDVNFLLQSKYEGAVT  
 TMV OB IPYINRVQNFPPYPKHFEKLQVDEVETRRTTLRCPGDVNFLLQSKYEGAVT  
 ORSV IPYINRVANFPYPKHFGHTCLHREVRRLSLRCPADVTHFMNSKYDGKFL  
 TVCV IPYICRVANFPYPYPAHFAKLVADEKEVRRVTLRCPADVTHYLNRRYEGFVM  
 CR-TMV IPYICRVANFPYPYPAHFAKLVADEKEVRRVTLRCPADVTHYLNRRYEGFVM  
 RMV-SH IPYICRVANFPYPYPAHFAKLVADEKEVRRVTLRCPADVTHYLNRRYEGFVM  
 CRMV IPYICRVANFPYPYPAHFAKLVADEKEVRRVTLRCPADVTHYLNRRYEGFVM  
 TMV-CG IPYICRVANFPYPKHFAKLVADEKEVRRVTLRCPADVTHYLNRRYEGFVM  
 CGMMV IPYINRVNFDYPKELRTLIVDNVERRYVTHRCPRDVTSLNTIYKAAVA  
 CGMMV-W IPYINRVNFDYPKELRTLIVDNVERRYVTHRCPRDVTSLNTIYKAAVA  
 CFMMV IPYINRVNFDYPLELRKIIVDTVEKRYTSKRCPRDVTSLNTIYKAAVA

YCGMMV IPFINRVMNFDYPLELKKIIVDDVEKRYTSKRCPROVDTHYLNEVYAAPVT  
 SHMV IPFINRVMNFSIPDNLAKLYYDEIVSRDITTKRCPLDVTHFLNSVYEKRV

301

TMV KR STSSVKKSVSQEMVGGAAVINP-ISKPLHGKILFTTQSDKEALLSRGYS-  
 TMV-RAK STSSVKKSVSQEMVGGAAVINP-ISKPLHGKILFTTQSDKEALLSRGYS-  
 P03586 TMVSTSSVKKSVSQEMVGGAAVINP-ISKPLHGKILFTTQSDKEALLSRGYS-  
 TOMV CTSSEKKSVSQEMVSGAASINP-VSKPLKGKILFTTQSDKEALLSRGYA-  
 PPMV CTSSVTRSVSHEVIQGAAMNP-VSKPLKGKIVFTTQSDKSLLSRGYE-  
 TMGMV TTSTVQRSVSSEMIGGKGVLSN-VSKPLKGKIVFTTQADKFELEEKGYK-  
 TMV OB TTSKTQSVGLEVVGGAAVMNP-VTKPLKGKIVFTTQSDKLTMLSRGYQ-  
 ORSV CTNDVIRSVDAEVVRGKGVFNP-KSKPLKGKIIFTTQSDKAELENERGYEE  
 TVCV CTSAVERSVAEVRGKGALNP-ITLPLEGKILFTTQADKFELLEKGYK-  
 CR-TMV CTSAVERSVAEVRGKGALNP-ITLPLEGKILFTTQADKFELLEKGYK-  
 RMV-SH CTSSVERSVAEVRGKGALNP-ITLPLEGKILFTTQADKFELLDKGYK-  
 CRMV CTSSVERSVAEVRGKGALNP-ITLPLEGKILFTTQADKFELLDKGYK-  
 TMV-CG CTSSVERSVAEVRGKGALNP-ITLPLEGKILFTTQADKFELLDKGYK-  
 CGMMV TTSPVHVSVAIKVSGAGILRP-ELTKIKGKIIFTTQSDKQSLIKSGYN-  
 CGMMV-W TTSPVHVSVAIKVSGAGILRP-ELTKIKGKIIFTTQSDKQSLIKSGYN-  
 CFMMV TTSPVHVSVTKKIAGVGLLRP-ELTALPGKIIFTTQNDKQTLKAGYA-  
 YCGMMV TSSAVHVSQKKIAGVGLLRP-ELTSLEGKIIFTTQSDKQTLKAGYE-  
 SHMV SYSNVQRSLECKMISGKAKINDYRSILAEGKLLFTTQEDKEYLLKAGFK-

351

TMV KR -----DVHTVHEVQGETYSDVSLVRLTPTPVSI IAGDSPHVLVALSRHTC  
 TMV-RAK -----EVHTVHEVQGETYSDVSLVRLTPTPISI IAGDSPHVLVALSRHTC  
 P03586 TMV-----DVHTVHEVQGETYSDVSLVRLTPTPVSI IAGDSPHVLVALSRHTC  
 TOMV -----DVHTVHEVQGETYADVSLVRLTPTPVSI IARDSPHVLVLSRHTK  
 PPMV -----DVHTVHEVQGETFEDVSLVRLTPTPVGIISKQSPHLLVLSRHTR  
 TMGMV -----NVNTVHEIQGETFEDVSLVRLTATPLTLISKSSPHVLVALTRHTK  
 TMV OB -----DVNTVHEIQGETYEEVSLVRLTPTPIHIIISRESPHVLVGLTRHTR  
 ORSV VSTFGEINTVHEIQGETFEDVSVRLTPTALELISKSSPHVLVALTRHTK  
 TVCV -----DVNTVHEVQGETYEKTAIVRLTSTPLEIISSASPHVLVALTRHTT  
 CR-TMV -----DVNTVHEVQGETYEKTAIVRLTSTPLEIIISRASPHVLVALTRHTT  
 RMV-SH -----DVNTVHEVQGETYEKTAIVRLTATPLEIIISRASPHVLVALTRHTT  
 CRMV -----DVNTVHEVQGETYEKTAIVRLTATPLEIIISRASPHVLVALTRHTT  
 TMV-CG -----DVNTVHEVQGETYEKTAIVRLTATPLEIIISRASPHVLVALTRHTT  
 CGMMV -----DVNTVHEIQGETFEETAVVRATPTPIGLIARDSPHVLVALTRHTK  
 CGMMV-W -----DVNTVHEIQGETFEETAVVRATPTPIGLIARDSPHVLVALTRHTK  
 CFMMV -----DVNTVHEVQGETYEETS VVRATATPIGLISRKSPHVLVALSRHTK  
 YCGMMV -----DVNTVHEVQGETYEECTSVVRATATPIGLISRKSPHVLVALSRHTK  
 SHMV -----DVNTVHEAQGETYRDVNLIRVTATPLTIVSAGSPHVTVALSRHTN

401

TMV KR SLKYYTVVMDPLVSIIRDLEKLSSYLLDMYKVDA  
 TMV-RAK SLKYYTVVMDPLVSIIRDLEKLSSYLLDMYKVDA  
 P03586 TMVSLKYYTVVMDPLVSIIRDLEKLSSYLLDMYKVDA  
 TOMV SLKYYTVVMDPLVSIIRDLERVSSYLLDMYKVDA  
 PPMV SIKYYTVVLDVAVSVLRDLECVSSYLLDMYKVDV  
 TMGMV SFKYYTVVLDPLVQIISDLSSLSSFLLEMYMVEA  
 TMV OB CFKYYTVVLDPLVKVLRDLECVSNFLLDVYMVDS  
 ORSV SFKYYCVVLDPLVKVCSDSLKVSDFILDYMYKVDA  
 TVCV CCKYYTVVLDPMVNVISEMEKLSNFLLDMYRVEA  
 CR-TMV RCKYYTVVLDPMVNVISEMEKLSNFLLDMYRVEA  
 RMV-SH RCKYYTVVLDPMVNVISELGKLSNFLLEMYKVES  
 CRMV RCKYYTVVLDPMVNVISELGKLSNFLLEMYKVES  
 TMV-CG RCKYYTVVLDPMVNVISEMEKLSNFILDMYKVES  
 CGMMV AMVYYTVVFDVAVTSIIADVEKVDQSILTMFATTV  
 CGMMV-W AMVYYTVVFDVAVTSIIADVEKVDQSILTMFATTV  
 CFMMV AMTYYTVTVDPVSCIIADLEKVDQSILSMYASVA

|        |                                    |
|--------|------------------------------------|
| YCGMMV | TMTYYTVTVDPVSCIIADLEKVDQSILSMYATVA |
| SHMV   | RFVYYTVVPDVVMTTVQKTQCVSNFLDMYAVAY  |

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